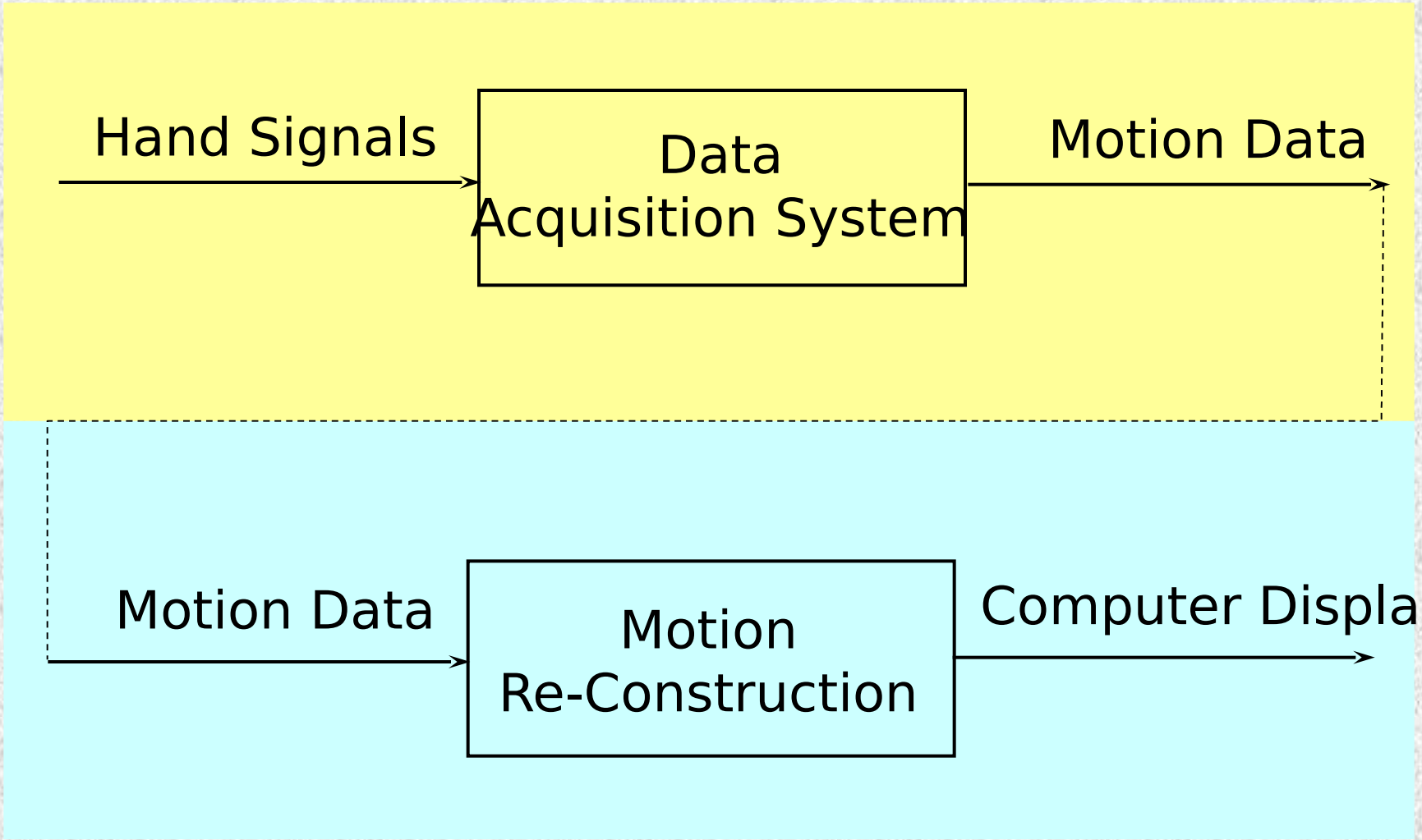
Pilot Signal tracking

—— Real-time Tracking & Display

TECHNICAL PROCEDURES:



Data Acquisition System:

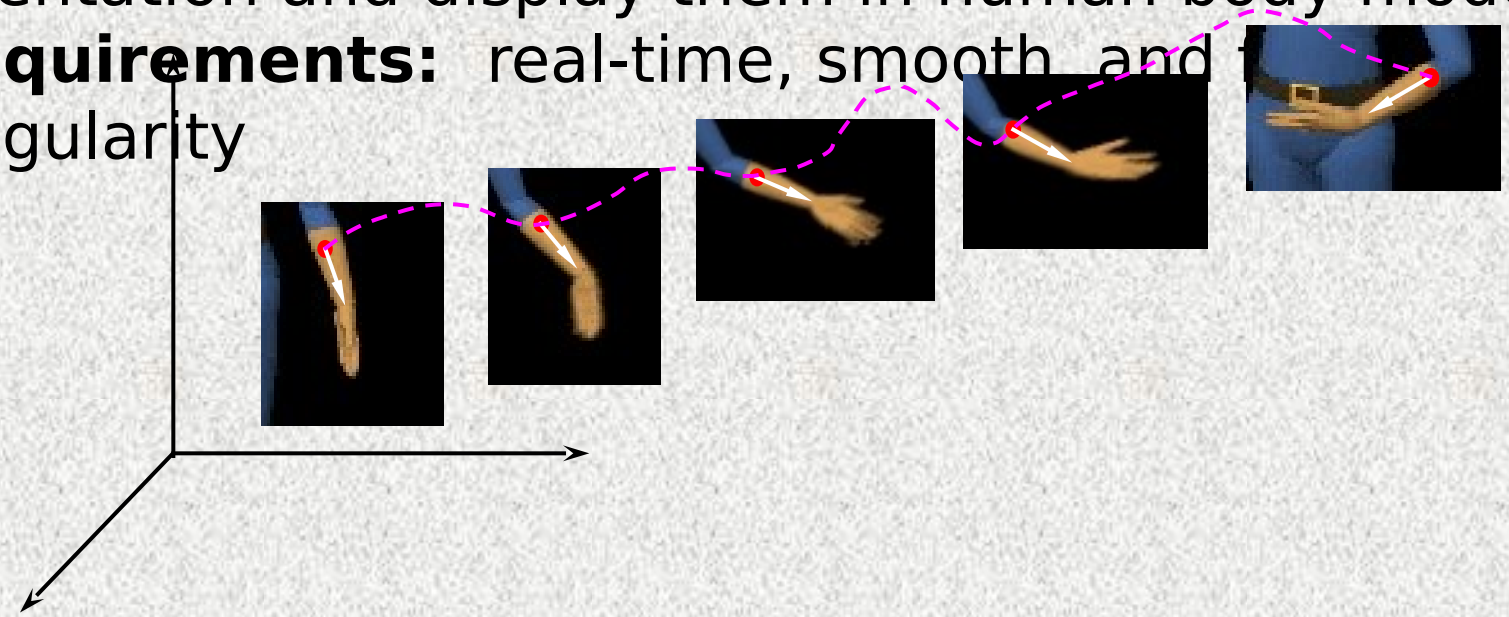
track and capture both position (x, y, z) and orientation (roll, pitch, yaw) of each body segment in space.

Requirements: accuracy, continuity, and high update rate

Motion Re-Construction:

re-construct all body segments' position and orientation and display them in human body model.

Requirements: real-time, smooth, and free singularity



DATA ACQUISITION:

Inertial:

uses linear multiple axis accelerometers and angular rate gyroscopes and numerical integration to locate the position and orientation of the object the sensors attached to.

Magnetic:

uses a source element radiating a magnetic field and a small sensor that reports its position and orientation with respect to the source.

Optical:

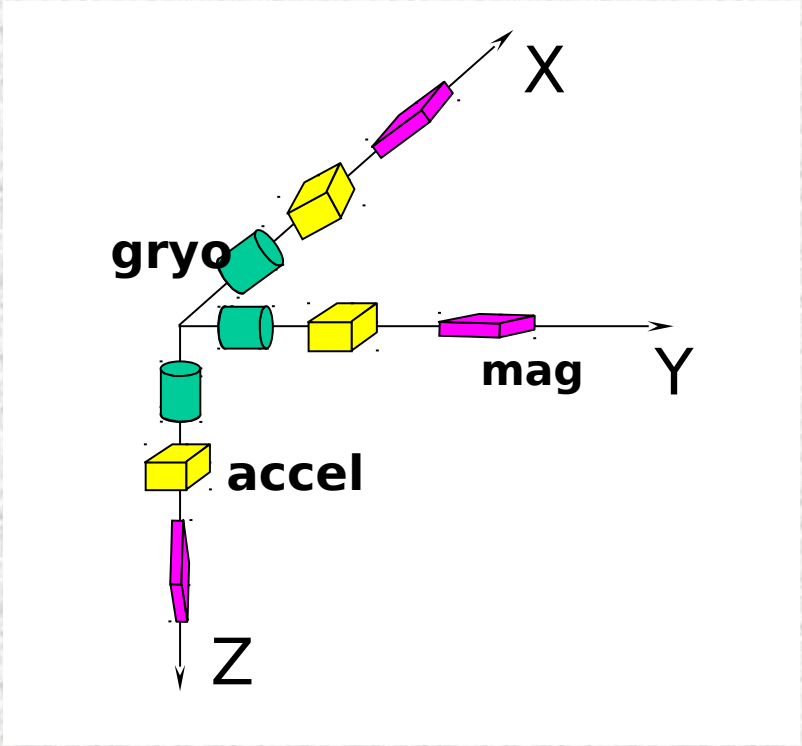
tracks small markers on the body, either flashing infrared LED’s or small reflective dots. Two or more cameras surrounding the subject picks out the markers in their visual field.

Acoustic:

uses high-frequency sound to triangulate a source within the work area.

InterSense System:

It tracks changes in orientation and position by integrating the outputs of its gyros and accelerometers, and correct drifts using a room-referenced ultrasonic time-of-flight range measuring system.



Ascension System:

Uses DC magnetic fields to track the real-time position and orientation of miniaturized sensors in space. The DC magnetic fields avoid blocking problems and yield reduced distortion from nearby conductive metals.

Station

Transmitter

Sensor

Human to computer avatar:

Tracking Issues

- Resolution
- Refresh rate
- Line of sight
- Wired vs wireless systems
- Initial and maintenance cost
- Setup and system integration
- Range
- Interference

TECHNICAL COMPARISONS:

	Inertial	Magnetic	Optical	Acoustic
Resolution (X/Y/Z)	2mm	2mm	2mm	2mm
Resolution (roll/pitch/yaw)	0.1º	0.2º	0.1º	0.2º
Range	>6m	6m	>4m	3m
Data Rate	>60Hz	>60Hz	>60Hz	~10Hz (8 disks)
Interference	None	Metal	Noise	None
Line-of-Sight	No	No	Yes	Yes
"Real-time"	Yes	Yes	No	Yes
Cost	medium	medium	high	medium
Testing Candidate				

Conclusions

- Both inertial and magnetic data acquisition systems can track and capture adequately accurate body motion and hand signals.
- Data update rate (>60Hz) of both systems provides smooth motion trajectories.
- Interference with metal in Ascension system is not a significant concern in this application.
- Initial lower cost, easier setup, lower maintenance of magnetic system led to choosing magnetic tracking system
- Smaller, cheaper, wireless sensor systems emerging